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United States
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Agriculture

Forest
Service

Intermountain
Region

1994

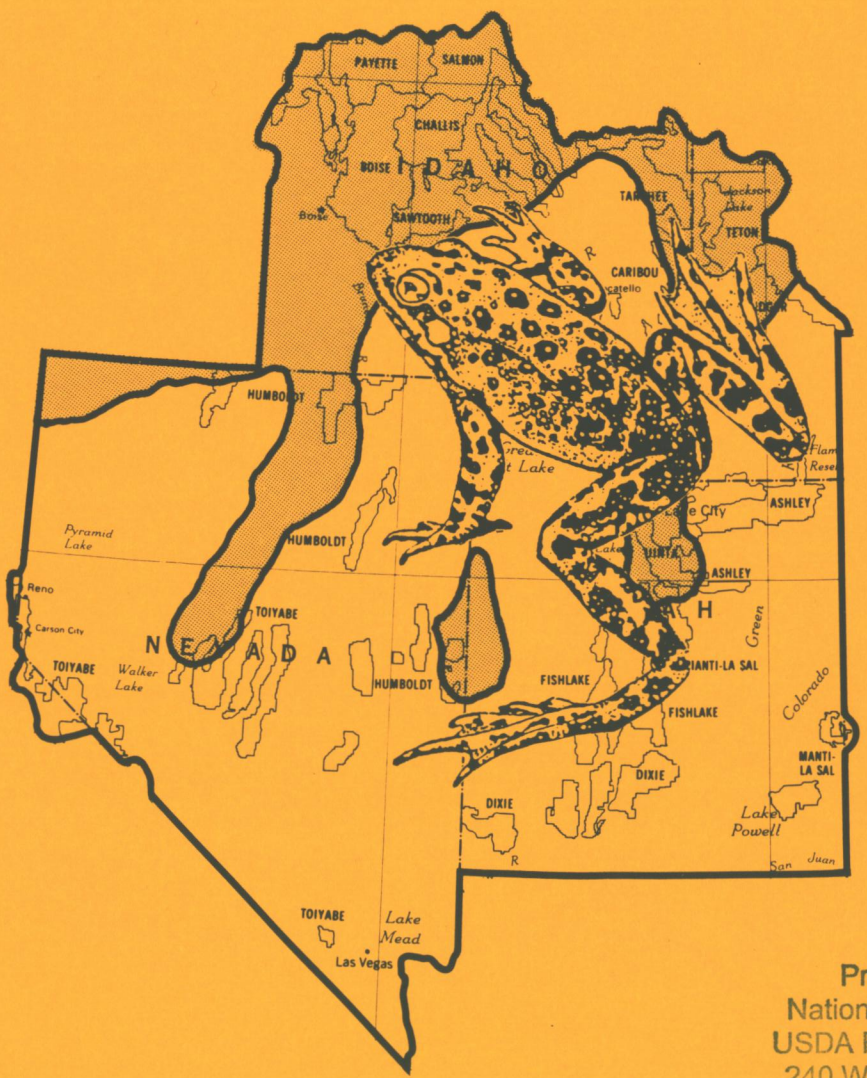
CONSERVATION ASSESSMENT

FOR THE SPOTTED FROG

(*RANA PRETIOSA*)

IN THE INTERMOUNTAIN REGION

USFS



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FOREWORD

This document is part of the Intermountain Region's "Center of Excellence" program. This program is designed to address sensitive vertebrate species within the Region. Twelve "Centers of Excellence" have been created. Each "Center of Excellence" is directed by a biologist who has a special interest in a particular species, and who has accepted the challenge of becoming the Regional coordinator for their species. The primary purpose of the program is to provide a central repository of all information on vertebrate sensitive species within the Intermountain Region. The goal of this effort is to synthesize the information gathered into a usable document referred to as a Conservation Assessment for each species. This document is the end result of that information gathering and contains information to help biologists increase their knowledge of spotted frog biology, their habitat requirements, and discusses the impacts current management activities may be having upon spotted frogs. This document will reduce duplication of work for individual biologists in the preparation of biological evaluations and will help ensure that Forest Service actions do not contribute to the decline of spotted frogs.

In the Intermountain Region of the Forest Service, the spotted frog (*Rana pretiosa*) can be considered to be an "early warning amphibian". The spotted frog is one of a half dozen amphibians found in the Intermountain Region but is currently the only species listed as sensitive by the Region. As a sensitive species, the spotted frog has been given special management emphasis to ensure its viability and to preclude trends towards endangerment that would result in the need for Federal listing.

INTRODUCTION

There is rising global concern about declining amphibian populations. Understanding declining amphibian populations is important for several reasons. First and most obvious, we need to know if and why amphibian populations are declining so we can effectively manage and preserve them. Secondly, amphibians are important components of many ecosystems, both as predators and prey, often making up a significant amount of a system's biomass (Peterson et. al. 1992.) Finally, amphibians are potentially sensitive indicators of environmental change because of their unique combination of biological characteristics (Wake and Morowitz 1990).

Because most amphibians live in both aquatic and terrestrial habitats, they are exposed to a wide range of environmental factors (temperature, radiation, environmental chemicals, prey, and predators). As ectotherms, they are very sensitive to changes in environmental temperatures and because many species of amphibians bask, they are also directly exposed to solar radiation. The thin, permeable skin of amphibians place them in intimate contact with environmental chemicals. Most species reproduce and develop in standing water where they are likely to encounter large concentrations of environmental chemicals. They also change trophic levels during their lives, being herbivorous as larvae and carnivorous as adults. Their populations are often isolated because of their limited vagility and may reflect changes on a relatively fine spatial scale. For these reasons, the use of amphibians as an "early warning system" of environmental change should be explored and developed.

Species Description

The spotted frog is a true frog (family *Ranidae*) measuring from less than 1 inch in length at transformation (tadpole to frog) to 4 inches maximum adult size. It is light brown, dark brown, or grayish above, with varying numbers of spots. The large dorsal spots often have light centers with indistinct or fuzzy edges. Although sometimes faint, there is a"mask" on the face. A light colored jaw strip usually reaches the shoulder. Adults are red, salmon, or yellow on the underside of the hindlimbs, depending on locality and age. In young, the yellow or orange ventral color is faint or absent. The legs are relatively short, and the heel of the hind limb

seldom reaches to the nostril. Eyes are turned slightly upward. Adult males may be distinguished by swollen and darkened pads at the base of the thumb.

Spotted frog populations south of the Salmon River, as well as in Nevada and Utah, usually are yellowish below, in most other locations, red predominate. The spotted frog emits a series of 4-50 faint, rapid, low pitched clicks, which increase in intensity during the call. The call also has been described as a series of 6-9 short bass notes. Calls last about 1-10 seconds, and may be given above, or occasionally under water (Stebbins 1985, Turner 1958).

Distinguishing spotted frog tadpoles from other species may be difficult. Tadpoles are dark brown to greenish in color, with flecks of gold underneath. Their eyes are set well in from the outline of the head. Tadpole size varies from 7mm to 70mm in total length depending upon age.

Taxonomy

Based on geographic and climatic separation and supported by genetic information, the U.S. Fish and Wildlife Service has identified the following distinct populations of the spotted frog: 1). The main population (Alaska, British Columbia, Alberta, Wyoming, Montana, northern and central Idaho, eastern Washington, and northeastern Oregon), (2) Great Basin (southern Idaho and Nevada), (3) west coast (western Washington and Oregon and northeastern California), (4) Wasatch Front (Utah), and (5) West Desert (Utah) (U.S. Fish and Wildlife Service 1993).

Food Resources

Adult spotted frogs feed on invertebrates, generally within one-half meter of shore on dry days. During and after rain, they may move away from permanent water to feed in wet vegetation or ephemeral puddles (Licht 1986). Adults also feed upon mollusks, crustaceans and arachnids. They are thought to be opportunistic feeders and feed underwater to some extent.

Green algae, most often *Spirogyra*, provides a food source and refuge for developing tadpoles (Morris and Tanner 1969, Licht 1974). Tadpoles consume decomposed plant material, and live green algae.

Habitat Use

Spotted frogs are most likely found near permanent water such as marshy edges of ponds or lakes, in algae-grown overflow pools of streams, or in wet areas with emergent vegetation. They may move considerable distances from permanent water after breeding, often frequenting mixed conifer and subalpine forests, grasslands, and brushlands of sage and rabbitbrush if puddles, seeps or other water is available.

Spotted frogs are thought to hibernate in holes near springs or other areas where water remains unfrozen and is constantly renewed. A muddy or soupy substrate in rivers or ponds is preferred by the spotted frog (Morris and Tanner 1969), principally for hibernation.

Morris and Tanner found the dominant aquatic vegetation in spotted frog habitat in Utah to be stonewort (*Chara sp.*). They also noted the presence of cattails (*Typha sp.*) in deep water, providing a cool, moist place for the frogs to feed during warm summer months. Spotted frogs prefer sunny or partially sunny areas with hiding cover in vegetation, soft substrates or overhanging banks.

Life History

The spotted frog breeds from late February to early July, beginning as early as the spring thaw will permit. A water temperature of 40 degrees F seems to be the critical temperature for emergence from hibernation (Morris and Tanner 1969).

Spotted frogs may be locally abundant when they congregate to breed in spring. Males gather at breeding locations, usually in shallow water, and begin calling. Calling is weak and intermittent. They do not defend territories.

Mating occurs during the day in shallow water. Eggs are deposited primarily in ponds or quiet water in clusters of several masses. These rounded egg masses are often softball sized, are not attached to vegetation, and rest on the bottom in shallow water or float with the top layers of eggs exposed at the surface. Clutch size ranges from 150-2000 eggs. Hatching time is dependant upon temperature and ranges from 3-21 days. Some tadpoles transform the following spring. Spotted frogs reach sexual maturity at 2-6 years of age depending on location and elevation. At higher elevations, spotted frogs grow and reach sexual maturity more slowly, have longer life spans, and may not breed every year. Maximal longevity may be 12 or 13 years (Turner 1960).

Development of tadpoles is temperature dependent. The age at transformation ranges from 70-85 days at higher elevations (Turner 1960) to 110-130 days at low elevations (Licht 1969). Frogs at higher elevations typically transform more quickly than their counterparts in lower elevation, and as a result, are usually smaller in size during their first year on land. Females often lay their eggs in communal clusters which may help in keeping their eggs warm. Often, it takes 2-3 years before a female can build up enough body reserves to lay eggs again. (Chuck Peterson, pers. comm.)

Range and Distribution

The spotted frog ranges from extreme southeastern Alaska through western Alberta, western Montana and northwestern Wyoming to northern Utah and central Nevada and west to the Pacific coast in Oregon and Washington (See Figure 1).

In the southern part of its range, it is represented primarily by isolated populations which may occur anywhere from sea level to 10,000 ft. in elevation. Although the spotted frog has a wide distribution, it reportedly is losing ground to the northern leopard frog (*Rana pipiens*) and the bullfrog (*Rana catesbiana*) in some areas, and now appears to be nearly extinct or declining on the periphery of their range in Washington, Oregon, California, Nevada, and Utah (McAllister and Leonard 1990).

The southernmost populations (southern Idaho, Nevada, and Utah) are believed to be relict populations occurring in small patches of suitable habitat remaining since the last ice age. The extreme western population (western Washington and Oregon and northeastern California) is believed to be a separate ecologic form confined to the warmer, milder climataic conditions of the west coast.

The main population of spotted frogs (in Alaska, Alberta, British Columbia, eastern Washington and Oregon, northern and central Idaho, and western Montana and Wyoming) occurs over a large area with a variety of habitat conditions.

The U.S. Fish and Wildlife Service believes that each of the disjunct populations is isolated from each other and from the main population by large distances with intervening stretches of unsuitable habitat or by disjunct climatic variations that form substantial geographic or ecological barriers.

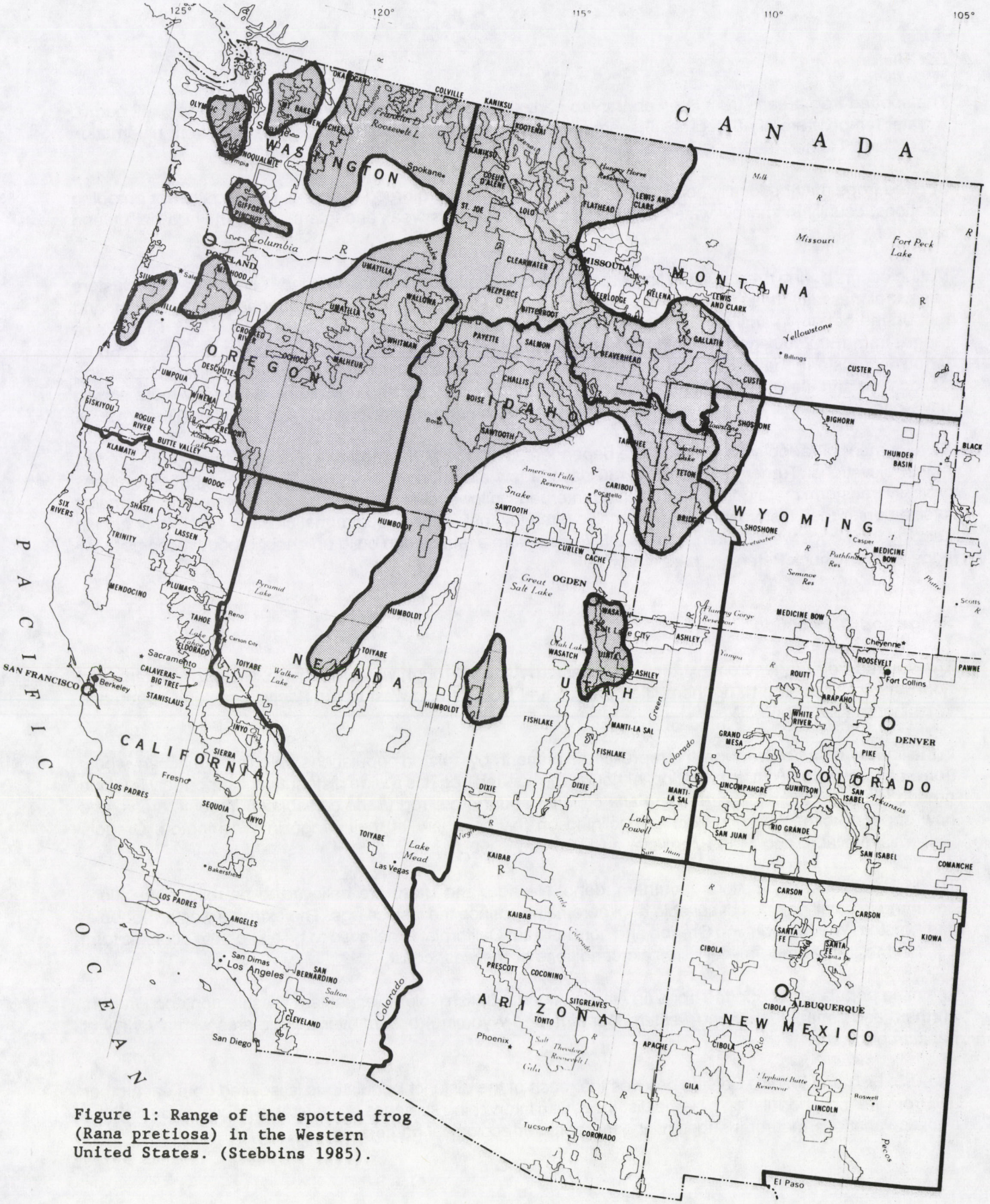

Figure 1: Range of the spotted frog (Rana pretiosa) in the Western United States. (Stebbins 1985).

Each of these disjunct populations is separated from other populations throughout its entire life cycle. These ecological and geographical barriers are believed to effectively prevent any interchange between any of the populations (U.S. Fish and Wildlife Service 1993).

MANAGEMENT

Status of the Spotted Frog

On April 23, 1993, the U.S. Fish and Wildlife Service announced a 12-month finding for a petition to amend the List of Endangered and Threatened Wildlife and Plants. The Service found that listing of the spotted frog as threatened in western Washington and Oregon, northeastern California, the Great Basin population (Nevada and southern Idaho), and the Wasatch Front population (Utah) is warranted, but precluded by other higher priority listing actions (U.S. Fish and Wildlife Service 1993).

In making this warranted-but-precluded finding for the above four populations identified above, the Service transferred these populations from Category 2 candidates to Category 1. The main population of the spotted frog is retained as Category 2 (Alaska, British Columbia, Alberta, Wyoming, Montanta, northern and central Idaho, eastern Washington, and northeastern Oregon).

Definitions:
-Category 1 (C1) - Taxa for which the U.S. Fish and Wildlife Service currently has substantial information on hand to support the biological appropriateness of proposing to list as endangered or threatened. Proposed rules have not yet been issued, but development and publication of proposed rules are anticipated.

-Category 2 (C2) - Taxa for which information now in possession of the U.S. Fish and Wildlife Service indicates that proposing to list as endangered or threatened is possibly appropriate, but for which conclusive data on biological vulnerability and threat are not currently available to support proposed rules. Further biological research and field study may be needed to ascertain the status of taxa in this category.

The spotted frog (*Rana pretiosa*) was listed as a Sensitive Species in Region 4 of the U.S. Forest Service on August 31, 1990. The Natural Heritage Program considers the status of the spotted frog globally as G5 - Demonstrably secure, though it may be quite rare in parts of its range, especially at the periphery.

Natural Heritage Program status in the western states comprising Region 4 are as follows:

STATE	STATUS	
Idaho	S5	Demonstrably secure, though it may be quite rare in parts of its range, especially at the periphery.
Wyoming	S3	Either very rare and local throughout its range or found locally (even abundant at some of its locations) in a restricted range, or because of other factors making it vulnerable to extinction throughout its range; in the range of 21 to 100 occurrences.
Utah	S1	Critically imperiled because of extreme rarity (5 or fewer occurences, or very few remaining individuals), or because of some factors of its biology making it especially vulnerable to extinction.
Nevada		The state of Nevada currently does not address the spotted frog in its Natural Heritage Program Base and offers no state protection.

Threats to the Population

While there are activities occurring within the main region (Alaska, Alberta, British Columbia, eastern Washington, and Oregon, northern and central Idaho, and western Montana and Wyoming) that potentially impact spotted frogs, and while some declines have been documented or are suspected, spotted frogs are believed to be abundant in most of these areas. However, the disjunct populations in the southern and western part of the species' range are either severely declining or nearly extirpated or are faced with significant threats altering or eliminating the species' habitat. Reduction, elimination, or alteration of wetland habitats has been a primary factor in each of these populations.

In the west coast population (western Washington and Oregon and northeastern California), spotted frogs have been nearly extirpated west of the Cascades from the Williamette Valley and Puget Sound and have disappeared from most locations in the Cascades and in northeastern California. Impacts in the Cascades have resulted from grazing and from the construction of reservoirs which have inundated large marsh complexes and fragmented remaining marshes, thereby reducing the survival of spotted frogs in these areas. Next to habitat loss, the second major factor affecting the west coast spotted frog population is the introduction and naturalization of nonnative predacious fishes and other nonnative aquatic species such as bullfrogs, that are believed to prey on tadpoles of spotted frogs and other native western *Rana* species.

In the Wasatch Front population in Utah, spotted frogs have undergone significant decline. Habitat loss and modification from reservoir construction and from urban and agricultural developments, compounded with predation by nonnative species, are the primary causes of the decline.

Spotted frogs of the Great Basin population (Nevada and southern Idaho) have undergone significant declines. Extensive loss of habitat has occurred from conversion of wetland habitats to irrigated pasture and dewatering of river areas by irrigation practices; in addition, there has been extensive impacts on riparian habitats primarily due to intensive livestock grazing.

While less habitat loss has occurred with the West Desert population of Utah than with the other southern and western populations, habitat availability is limited. Degradation of spring habitats and water quality from cattle grazing and other agricultural activities in these limited habitats are potential threats to the spotted frogs of this population (U.S. Fish and Wildlife Service 1993).

Potential management threats and concerns

Some of the specific management related threats to the spotted frog include timber harvest, grazing, road and trail construction, water diversion projects, fire, chemical compounds and the introduction of exotic species.

Information on the potential effects management practices may be having upon spotted frogs is limited and is in need of further study. Further research needs are discussed in the research needs section of this document.

Timber Harvest

Timber harvest could potentially affect spotted frogs in a number of ways. Sedimentation from logged areas may fill interstitial habitat and habitat adjacent to streams and render those habitats inaccessible. Post-logging changes in the water table could also flood or dry up seep habitat and may alter the stream flow regime. Removal of overstory canopy could modify water temperature and affect spotted frogs or their prey. Elimination of canopy cover between sites could reduce or terminate movement of frogs between sites,

increasing fragmentation of populations, and, consequently, increase the likelihood of localized extinctions (Idaho Game and Fish 1991).

Grazing

Threats upon spotted frogs resulting from livestock or grazing includes reducing vegetation along ponds and riparian areas, reducing habitat for foraging, thermal regulation, and hiding cover from predators. A decrease in cover also increases water temperature and may result in higher egg and tadpole mortality. Additional threats include trampling of frogs by livestock, especially on stock trails near spotted frog habitat, degradation of spring habitats and water quality from cattle grazing, especially where habitat availability is limited.

Road and Trail Construction

Sedimentation from road construction could have effects similar to or even more severe than those from timber harvest. Blasting or quarrying of talus for road construction near seeps could eliminate habitat and destroy spotted frog populations. For frogs foraging at roadside seeps and near trails, mortality from traffic may be a factor. Expansion of roads and highways in the Intermountain West has resulted in the loss of numerous ponds providing spotted frog habitat. Roads may fragment habitat areas, altering habitat use and dispersal patterns (Chuck Peterson, pers. comm.).

Water Diversion Projects

Alteration of stream flows by impounding water may eliminate habitat. Areas that are drained result in loss of spotted frog habitat. Wells often lower the water table and dry up riparian complexes. Construction of dams and reservoirs have inundated large marsh complexes and fragmented remaining marshes. Extensive loss of habitat has occurred from conversion of wetland habitats to irrigated pasture and dewatering of river areas by irrigation practices.

Fire

In the case of severe wildfires, the loss of canopy cover could have several negative effects upon spotted frogs. Water temperatures could increase resulting in temperatures not suited for egg development. Dispersal among sites could be more difficult, increasing fragmentation and the likelihood of localized extinction. Prescribed burns in the early spring could disturb breeding activities.

Pesticides

The effects of chemicals on amphibians can be classified into five categories; direct mortality, sublethal effects such as reduced growth and development, effects on reproduction, behavior, and biochemical processes (Bishop 1992). For information on the effects of some of the more common pesticides upon amphibians see Appendix C.

Direct mortality is uncommon as long as the level of application does not exceed legal dosage. That dosage which results in direct mortality is dependent upon stage of development, species, and the pesticide involved.

Eggs, larvae and tadpoles are highly susceptible to reduced growth and development due to exposure to pesticides. Delayed metamorphosis, paralysis, reduced growth rates, and mortality of tadpoles have been documented. Common deformations resulting from pesticide application include tail deformations and ede-

ma, notochord waviness, and abnormalities in the head and trunk (Pawar et al. 1983). A delay in metamorphosis may place larvae at greater risk of predation and dehydration, as ephemeral ponds dry through the year.

Effects upon reproduction include reduced hatching success of eggs. Amphibians appear to be most susceptible to pesticides when they are at the yolk plug stage of development (Bancroft and Prahlad 1973).

Poor swimming ability, twitching, loss of balance, and changes in rates of feeding in amphibian larvae are the reported behaviorial effects of laboratory exposures to pesticides. Behavioral effects are common as most pesticides are neurotoxic.

Biochemical effects may include a reduced tolerance to low temperatures (Johnson 1980). This may have serious implications to amphibians in higher elevations.

The amount and quality of food and shelter for amphibians may be reduced when insecticides and herbicides contaminate wetland ecosystems. Herbicides can be toxic to algae and aquatic macrophytes (Butler 1977). The loss of algae as food for tadpoles, loss of invertebrates as food for amphibian adults and larvae, and loss or reduction of macrophytes that provide shade and shelter from predators (Wassersug 1989) could presumably have devastating impacts on amphibian populations.

Exotic Species

Introduction of exotic species could reduce spotted frog populations if they prey on spotted frogs or directly compete for space or food. Interspecific competion with northern leopard frogs has resulted in the loss of spotted frog populations. Bullfrogs have been known to prey upon smaller toads and frogs.
Non-native predacious fishes are believed to prey on tadpoles of spotted frogs and other native western *Rana species* (U.S. Fish and Wildlife Service 1993).

MONITORING AND SURVEYING TECHNIQUES

Results of the questionnaire circulated to all 16 of the National Forests in Region 4 has shown that in most cases, basic surveys to gather baseline data as to whether spotted frogs occur on individual forests are needed.

Surveying for amphibians is not very time consuming and can often be incorporated into other work activites ie. stream surveys, riparian surveys..etc..Some sampling techniques include:

A. Incidental observations-Observations during other field work or time off.
(See observation form in the appendix)

Pros-With minimal training, personnel can "keep a look out" for amphibians during routine work (timber crews, trail crews). Usually results in alot of information being reported.
Cons-A short training session is usually required to help crews distinguish species. Species may be misidentified. The amount of information reported relies heavily on the interest of the crews in amphibians.

B. Seize and capture-One step above incidental observations and requires capturing the amphibian to better determine species, sex and relative age.

Pros-Results in more accurate information.
Cons-More time consuming that incidental observations.

C. Timed or Time constrained Searches-Limiting the survey to a specific period of time or timing surveys to get an idea on effort expanded during the survey.

Pros-Provides consistent data. Gives some indication as to effort for future references. Quantifies effort.
Cons-Can be time consuming.

D. Area constrained searches-Limiting the survey to one pond, lake...
Pros-Results in thorough searches of particular sites. Often get a good idea on abundance and more likely to discover egg masses, tadpoles...
Cons-Time consuming.

E. Trapping (pit and funnel traps with drift fences)-Involves installing a drift fence around the perimeter of a pond and creating pit traps every 10 meters to catch frogs following the fence.
Pros-Provides good information on species presence and abundance.
Cons-Very time consuming. Requires daily monitoring and set up and repair of drift fences and traps.

F. Seining-Using dipnets or seines to survey with.
Pros-Often results in tadpole collection.
Cons-Amphibians in shallow water are often missed.

G. Calling surveys-Involves listening for calls to determine presence.
Pros-Usually able to cover numerous sites in a short time.
Cons-Only works for species that call.

Once basic surveys to determine presence/absence and relative abundance are conducted, a monitoring program can be developed. The purpose of a monitoring program is to examine long term changes in amphibian abundance. Sites being monitored should be sampled several times a year. In addition to information on frog species present and relative abundance, information on pH, water conductivity, and ion content can also be obtained by collecting water samples and submitting to the U.S. Forest Service in Fort Collins, Colorado. (See survey and monitoring sheets in Appendix F and G).

Results from Regional Questionnaire - Where do we go from here?

A questionnaire was submitted to all 16 of the National Forests in the Region asking individual forests their perception of the status of spotted frogs on their units. Nine Forests have at least one known population of spotted frogs, three Forests have no populations of spotted frogs, and the status of spotted frog populations are not known on four Forests. (See Appendix A).

Forests were also asked about what they perceived to be their greatest need to manage spotted frogs and amphibians as a whole. Information on habitat requirements was the most frequently mentioned need. Information on surveying techniques and amphibian identification was also a high priority.

Results from this survey have demonstrated the lack of information the majority of forests have on spotted frogs and amphibians as a whole. Courses on amphibian identification and surveying techniques are needed before most Forests can complete amphibian surveys. Hopefully, this document will provide biologists needed information on spotted frog habitat requirements and gives direction on potential management effects.

Further Research Needs

Much information on spotted frog biology and life cycle is already known. Information on aquatic habitat requirements is also readily available. Most Forest plans contain standards and guidelines to protect riparian

areas and thus also protect spotted frogs to an extent. From questionnaires and discussions with biologists throughout the Region, the biggest research need is to determine the effects management activities are having upon spotted frogs and amphibians as a whole. Studies to determine these effects have not occurred at this time.

A high priority concern in need of study, particulary in the Wasatch front and West Desert populations, are the effects grazing may be having upon amphibian populations. Limited grazing should have little effect upon amphibians however, in areas where water is scarce, ponds and riparian areas are often heavily used by livestock, and amphibian populations may be decreasing.

Another high priority concern in need of study are the effects logging may be having upon amphibian populations. Studies on the effects of timber harvest on amphibians in the states of Washington, Oregon and California, indicate that some species of salamanders are associated with older forest and are absent or less abundant in logged areas. Implications of various harvest or burn patterns across the landscape on individual movements and population dynamics have yet to be determined (Idaho Fish and Game 1991). Preliminary results from a toad study in Idaho has shown that toads avoid clearcuts (Chuck Peterson, pers. comm.).

Additional studies on the effects of pesticides under field conditions are needed to help determine the extent that environmental contamination through pesticide application is contributing to the decline in amphibian populations.

Information on how individuals or populations of amphibians responded to natural successional changes is lacking. Research is needed to determine the relationship between amphibians and natural system processes to better emulate those conditions now with our current management practices.

Studies examining the effects of these management activities are needed to help managers make better land management decisions and to help managers further understand the implications of their decisions upon amphibians and the ecosystem as a whole.

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APPENDICES

Appendix A - Status of the spotted frog in Region 4

FOREST	SPOTTED FROG STATUS INTERMOUNTAIN REGION
ASHLEY	Suitable habitat appears to exist. Surveys have not been conducted but the Forest would like to do more for amphibians.
BOISE	Unsure if spotted frogs occur on the Forest. Basic information on biology, survey techniques is needed.
BRIDGER-TETON	Spotted frogs are common on the Forest and populations seem to be doing well.
CARIBOU	Spotted frogs may occur on the Forest. Information on six amphibian species which may occur on the Forest is limited.
CHALLIS	They seem to be fairly common on the Forest but status is not clear. Grazing impacts upon amphibians is biggest concern.
DIXIE	Spotted frogs do not occur on the Forest according to state information.
FISHLAKE	Status is unsure. Information on surveying and effects of management activities upon amphibians is needed.
HUMBOLT	They are found on the Mtn. City and Jarbidge Ranger Districts. Status is not known on other Districts. Population has probably decreased in the last 100 years.
MANTI-LASAL	Suitable habitat for spotted frogs does not exist. They do occur adjacent to the Forest in lower elevations.
PAYETTE	All Districts have reports of spotted frogs. Populations seem to be stable.
SALMON	Occur on the northern half of the Forest. Populations there seem to be stable as observed through informal surveys.
SAWTOOTH	They are found in the northern part of the Forest. Status is uncertain.
TARGHEE	They are common throughout the Forest with the exception of the Palisades Ranger District where no recent records are known.
TOIYABE	Spotted frogs occur in the higher Sierras in the Carson and Bridgeport Ranger Districts. Status of known populations is unknown.
UINTA	The entire Forest has been surveyed with 1 population found. Need to develop a management plan for the known population.
WASATCH-CACHE	State surveys have not found any spotted frogs on the Forest.

Appendix B - Surveying/Monitoring Methods and Tips

The most often used form of surveying for spotted frogs are timed/time constrained searches and area constrained searches. These methods are simple, relatively non-time consuming, and provide good data.

It is best to have two or more people surveying. Surveyers should line up approximately five feet apart and slowly step forward watching the ground in front of them and to both sides. When surveying ponds or lakes, one person should be at the water's edge, the other in the water. With more than three people, surveyers should remain spaced at 5 feet. More surveyers generally means that more deep water can be surveyed. Water deeper than 2 feet should not be surveyed as most spotted frogs are found near shore.

Surveyers should remain in line with each other. In most sites, mud is churned up during the search making visibility difficult. Once a frog is spotted, everyone in the line should stop until the frog is captured and identified. Quite often if the frog escapes, it is still possible to catch it by making several sweeps with a net in the area where it was last observed. Nets are important equipment for surveying. Fine meshed nets are a must. It is best to have two nets, one with a long handle and another with a short handle (aquarium version net). Long handled nets can be purchased at any sporting goods store and aquarium nets can be purchased at most pet stores.

Tips

* Spring - early Summer are best for surveying as frogs are concentrated in breeding areas.

* It is best to survey on a warm, sunny day between noon and 4:00 pm. It is during this time that amphibians are most active.

* Visibility is best when cloud cover is not heavy.

* Most spotted frogs are found on the waters edge and in shallow water less than one foot deep.

* Tadpoles are most often found in or near dense aquatic vegetation.

* It is important to survey using your ears as well as your eyes (listen for calling and splashes made by jumping frogs).

* Spotted frogs are difficult to locate in cold weather.

* Recording location and basic habitat information in the fall could provide important hibernation information.

Equipment

* Hip Boots
* Nets (long handled fine meshed and aquarium net)
* Holding containers come in handy for comparing collected specimens.
* Thermometer, pH kit
* Survey/monitor forms, pencils, map

Appendix C - List of common pesticides and their known effects upon amphibians

Insecticides	Herbicides	Fungicides
Carbaryl (g,r,b,bc) Carbofuran (b,bc) Chlorpyrifos (bc) Dimethoate (g,bc) Fenitrothion (g) Lindane (g,r) Malathion (r,b)	Atrazine (r) 2,4-D (g)	Maneb (g,r,b,bc)

Laboratory studies have shown that this pesticide can effect:

g-Growth rates and development.

r-Reproduction success.

b-Behavior

bc-Biochemical processes

Appendix D - Literature Search-Additional Information

* In order to obtain publications of interest, send AD-145's (i.e. Request for Publication) to Washington State Library, Interlibrary Loan, Owen Science and Engineering Library, Pullman, WA 99164-3200.

3/7/5 (Item 3 from file: 50)
0162247 7E005-01357
Food habits of the spotted frog (Rana pretiosa) from managed sites in Grant County, Oregon.
Whitaker, J. O. Jr.; Cross, S. P.; Skovlin, J. M.; Maser, C.
Department of Life Sciences, Indiana State University, Terre Haute, IN 47809, USA.
Northwest Science 1983. 57 (2): 147-154 (11 ref.)
Language: English
The great variety of insect food, including distasteful types, eaten by Rana pretiosa indicates that it is an opportunistic feeder. Changes in the composition of local insect populations caused by land management practices at different sites in Oregon are reflected in the diet of the frog.

3/7/8 (Item 2 from file: 185)
1102406 Vol 127 Sec 16 Cit 00731
RANA PRETIOSA (SPOTTED FROG).
LINDEMAN, P.V.
HERPETOL REV 21(2) 1990: 38.

3/7/10 (Item 4 from file: 185)
0949693 Vol 125 Sec 16 Cit 00707
WESTERN SPOTTED FROG (RANA PRETIOSA) MORTALITY FOLLOWING FOREST SPRAYING OF DDT.
KIRK, J.J.
HERPETOL REV 19(3) 1988: 51-53, ILLUSTR.

3/7/13 (Item 7 from file: 185)
0702690 Vol 123 Sec 16 Cit 00852
FOOD AND FEEDING BEHAVIOR OF SYMPATRIC RED-LEGGED FROGS, RANA AURORA, AND SPOTTED FROGS, RANA PRETIOSA IN SOUTHWESTERN BRITISH COLUMBIA.
LICHT, L.E.
CANADIAN FLD NAT. 100(1) 1986: 22-31, ILLUSTR.

3/7/14 (Item 8 from file: 185)
0702689 Vol 123 Sec 16 Cit 00851
COMPARATIVE ESCAPE BEHAVIOR OF SYMPATRIC RANA AURORA AND RANA PRETIOSA.
LICHT, L.E.
AMERICAN MIDL. NAT. 115(2) 1986: 239-247, ILLUSTR.

3/7/16 (Item 10 from file: 185)
0702380 Vol 123 Sec 16 Cit 00542
SYSTEMATICS AND EVOLUTION OF WESTERN NORTH AMERICAN FROGS ALLIED TO RANA AURORA AND RANA BOYLII: ELECTROPHORETIC EVIDENCE.
GREEN, D.M.
SYSTEMATIC ZOOL. 35(3) 1986: 283-296, ILLUSTR.

3/7/18 (Item 12 from file: 185)
0702030 Vol 123 Sec 16 Cit 00192
BREEDING BIOLOGY OF THE CASCADE FROG, RANA CASCADAE, WITH COMPARISONS TO

R. AURORA AND R. PRETIOSA.
BRIGGS, J.L., SR
COPEIA 1987(1) 1987: 241-245, ILLUSTR.

3/7/19 (Item 13 from file: 185)
0626783 Vol 122 Sec 16 Cit 00436
NATURAL HYBRIDS BETWEEN THE FROGS RANA CASCADAE AND RANA PRETIOSA (ANURA: RANIDAE).
GREEN, D.M.
HERPETOLOGICA 41(3) 1985: 262-267, ILLUSTR.

3/7/22 (Item 16 from file: 185)
0140357 Vol 115 Sec 16 Cit 00715
OBSERVATIONS ON THE DIETS OF RANA PRETIOSA, RANA PIPIENS, AND BUFO BOREAS FROM WESTERN MONTANA.
MILLER, J.D.
NORTHWEST SCI. 52(3)(II) 1978: 243-249, ILLUSTR.

3/7/23 (Item 17 from file: 185)
0139904 Vol 115 Sec 16 Cit 00262
SEXUAL DIMORPHISM IN AN ANURAN RESPONSE TO SEVERE THERMAL STRESS (AMPHIBIA, ANURA).
DAUGHERTY, C.H.; WISHARD, L.N.; DAUGHERTY, L.B.
JOURNAL HERPET. 12(3) 1978: 431-432, ILLUSTR.

3/7/24 (Item 18 from file: 185)
0139853 Vol 115 Sec 16 Cit 00211
BIOCHEMICAL SYSTEMATICS OF MEMBERS OF THE GENUS RANA NATIVE TO WESTERN NORTH AMERICA.
CASE, S.M.
SYSTEMATIC ZOOL. 27(3) 1978: 299-311, ILLUSTR.

3/7/26 (Item 2 from file: 5)
7556462 BIOSIS Number: 39069069
DECLINING AMPHIBIAN POPULATIONS A GLOBAL PHENOMENON BLAUSTEIN A R; WAKE D B
DEP. ZOOL., OREGON STATE UNIV., CORVALLIS, OREGON 97331-2914, USA.
TRENDS ECOL EVOL 5 (7). 1990. 203-204. CODEN: TREEE
Full Journal Title: Trends in Ecology & Evolution
Language: ENGLISH

3/7/27 (Item 3 from file: 5)
7499378 BIOSIS Number: 39011985
WHERE HAVE ALL THE FROGS AND TOADS GONE
PHILLIPS K
PASADENA, CALIF.
BIOSCIENCE 40 (6). 1990. 422-424. CODEN: BISNA
Full Journal Title: Bioscience
Language: ENGLISH

3/7/30 (Item 6 from file: 5)
5590441 BIOSIS Number: 32112748
BREEDING BIOLOGY OF THE CASCADE FROG RANA-CASCADAE WITH COMPARISONS TO

RANA-AURORA AND RANA-PRETIOSA
BRIGGS J L SR
SCS ENGINEERS, 11260 ROGER BACON DRIVE, RESTON, VA. 22090.
COPEIA 1987 (1). 1987. 241-245. CODEN: COPAA
Full Journal Title: Copeia
Language: ENGLISH

3/7/31 (Item 7 from file: 5)
5446251 BIOSIS Number: 82091054
FOOD AND FEEDING BEHAVIOR OF SYMPATRIC RED-LEGGED FROGS RANA-AURORA AND SPOTTED FROGS RANA-PRETIOSA IN SOUTHWESTERN BRITISH-COLUMBIA CANADA
LICHT L E
DEP. BIOL., YORK UNIV., 4700 KEELE ST., DOWNSVIEW, ONTARIO M3J 1P3.
CAN FIELD-NAT 100 (1). 1986. 22-31. CODEN: CAFNA
Full Journal Title: Canadian Field-Naturalist
Language: ENGLISH
The food and feeding behavior of Rana aurora and Rana pretiosa sympatricin marshes in southwestern British Columbia were studied. Newly metamorphosed and juvenile/adult frogs of each species were compared on the basis of frequency of occurrence of food type eaten and the abundance of each food type eaten. Rana pretiosa took more aquatic prey than R. aurora which fed more heavily on terrestrial prey types. Newly metamorphosed frogs had the highest inter-specific overlap (80%) in diet. Rana pretiosa feed predominantly in water, floating on the water surface or clinging to aquatic vegetation. On wet days only, R. pretiosa feed on land along the river margin or in or along rainpools. Rana aurora feed almost exclusively on land, along the river margin and in the vegetation.

3/7/35 (Item 1 from file: 35)
507699 ORDER NO: AAD74-23478
GROWTH RATES AND MOVEMENTS WITHIN A POPULATION OF RANA PRETIOSA PRETIOSA (BAIRD AND GIRARD) IN SOUTH CENTRAL MONTANA.
Author: HOLLENBECK, ROBERT RUDOLPH
Degree: PH.D.
Year: 1974
Corporate Source/Institution: MONTANA STATE UNIVERSITY (0137)

3/7/36 (Item 2 from file: 35)
270177 ORDER NO: AAD65-05526
EARLY DEVELOPMENT, EMBRYONIC TEMPERATURE TOLERANCE AND RATE OF DEVELOPMENT IN RANA PRETIOSA LUTEIVENTRIS, THOMPSON
Author: JOHNSON, OLIVER WILLIAM
Degree: PH.D.
Year: 1965
Corporate Source/Institution: OREGON STATE UNIVERSITY (0172)

3/7/37 (Item 3 from file: 35)
117669 ORDER NO: NOT AVAILABLE FROM UNIVERSITY MICROFILMS INT'L.
THE ECOLOGY AND MORPHOLOGY OF RANA PRETIOSA PRETIOSA IN YELLOWSTONE PARK, WYOMING
Author: TURNER, FREDERICK BROWN
Degree: PH.D.
Year: 1958
Corporate Source/Institution: UNIVERSITY OF CALIFORNIA, BERKELEY (0028)
. 172 PAGES

3/7/39 (Item 2 from file: 434)
01413317 Genuine Article#: CY458 Number of References: 0
(NO REFS KEYED)
Title: WOOD AND WESTERN SPOTTED FROGS (AMPHIBIA, ANURA, RANIDAE) IN BIG-HORN MOUNTAINS OF WYOMING
Author(s): DUNLAP DG
Corporate Source: UNIV S DAKOTA,DEPT BIOL/VERMILLION//SD/57069
Journal: JOURNAL OF HERPETOLOGY, 1977, V11, N1, P85-87
Language: ENGLISH Document Type: NOTE

3/7/40 (Item 3 from file: 434)
00854324 Genuine Article#: AZ987 Number of References: 14
Title: COMPARATIVE LIFE-HISTORY FEATURES OF WESTERN SPOTTED FROG, RANA-PRETIOSA, FROM LOW-ELEVATION AND HIGH-ELEVATION POPULATIONS Author(s): LICHT LE
Journal: CANADIAN JOURNAL OF ZOOLOGY-JOURNAL CANADIEN DE ZOOLOGIE, 1975, V 53, N9, P1254-1257
Language: ENGLISH Document Type: ARTICLE

3/7/41 (Item 4 from file: 434)
00434356 Genuine Article#: V0458 Number of References: 0
Title: EFFECTS OF CHRONIC LOW LEVEL IRRADIATION FROM CS-134 ON DEVELOPMENT OF WESTERN SPOTTED FROG (RANA-PRETIOSA)
Author(s): BREARLEY A
Corporate Source: OREGON STATE UNIV,GEN SCI DEPT/CORVALLIS//OR/97331
Journal: HEALTH PHYSICS, 1974, V27, N6, P644-645
Language: ENGLISH Document Type: MEETING ABSTRACT

3/7/42 (Item 5 from file: 434)
00204144 Genuine Article#: T1790 Number of References: 22
Title: SURVIVAL OF EMBRYOS, TADPOLES, AND ADULTS OF FROGS RANA-AURORA-AURORA AND RANA-PRETIOSA-PRETIOSA SYMPATRIC IN SOUTHWESTERN BRITISH-COLUMBIA
Author(s): LICHT LE
Corporate Source: YORK UNIV,DEPT BIOL/DOWNSVIEW M3J 1P3/ONTARIO/CANADA/
Journal: CANADIAN JOURNAL OF ZOOLOGY-JOURNAL CANADIEN DE ZOOLOGIE, 1974, V 52, N5, P613-627
Language: ENGLISH Document Type: ARTICLE

3/7/45 (Item 1 from file: 117)
056851 W73-07491
BREEDING HABITS AND EMBRYONIC THERMAL REQUIREMENTS OF THE FROGS, RANA AURORA AND RANA PRETIOSA PRETIOSA, IN THE PACIFIC NORTHWEST
LICHT, L. E.
BRITISH COLUMBIA UNIV., VANCOUVER. DEPT. OF ZOOLOGY.
ECOLOGY, VOL 52, P 116-124, 1971. 2 FIG, 3 TAB, 14 REF.,
EMBRYONIC THERMAL ADAPTATIONS OF TWO SPECIES OF FROGS FROM THE PACIFIC NORTHWEST ARE DESCRIBED. LIMITS OF TEMPERATURE TOLERANCE OF YOUNG R. AURORA EMBRYOS ARE ABOUT 4-21 C. FOR ANOTHER SPECIES, R. PRETIOSA, THE LETHAL THERMAL LIMITS OF YOUNG EMBRYOS ARE APPROXIMATELY 6-28 C. THE TOLERANCE LIMITS BROADEN AS EMBRYOS BECOME OLDER, AND EMBRYOS OF BOTH SPECIES CAN SURVIVE SHORT-TERM EXPOSURE TO NORMALLY LETHAL CHRONIC COLD TEMPERATURES. FIELD OBSERVATIONS OF BREEDING FROGS INDICATE A CORRELATION BETWEEN BREEDING HABITS - SUCH AS INITIATION OF BREEDING SEASON, TIME OF DAILY SEXUAL ACTIVITY, MALE CALLING BEHAVIOR, AND SPAWNING SITE - AND EMBRYONIC THERMAL REQUIREMENTS. HIGH MORTALITY OF R. PRETIOSA EMBRYOS IN THE FIELD OFTEN RESULTS FROM FREEZING TEMPERATURES AT NIGHT AND DESICCATION OF EGG MASSES. THESE FACTORS DO NOT GREATLY AFFECT R. AURORA EMBRYOS. THESE THERMAL ADAPTATIONS OF THE TWO WESTERN SPECIES OF RANA ARE COMPARED WITH THOSE OF SPECIES FROM EASTERN NORTH AMERICA, AS AN AID IN BROADENING THE UNDERSTANDING OF THE EVOLUTIONARY STRATEGIES WITHIN THE GENUS IN NORTH AMERICA. (OLESZKIEWICZ - VANDERBILT)

3/7/51 (Item 2 from file: 704)
06537007
STUDY AIM: WHY ARE FROGS DYING?
Oregonian (PO) - THURSDAY, February 6, 1992
Edition: FOURTH Section: SCIENCE Page: E03
Word Count: 420

3/7/52 (Item 3 from file: 704)
05665154
CASCADE FROG POPULATION HEADS TOWARD EXTINCTION
OREGONIAN (PO) - THURSDAY June 14, 1990
By: JEFF BARNARD - The Associated Press
Edition: FOURTH Section: SCIENCE Page: E02
Word Count: 594

3/7/54 (Item 5 from file: 704)
05355129
AMPHIBIANS ON THE WANE
OREGONIAN (PO) - THURSDAY December 21, 1989
By: From staff and wire reports
Edition: FOURTH Section: SCIENCE Page: B01
Word Count: 151

TITLE: THE PAST DISTRIBUTION AND CURRENT STATUS OF THE SPOTTED FROG (RANA PRETIOSA) IN WESTERN WASHINGTON.
AUTHOR: Leonard, William P.
SOURCE: Northwest Sci.; 66(2):125. 1992. Abstract only.
GEO. AREA: Washington, Western

3/7/46 (Item 1 from file: 144)
10652833 PASCAL No.: 93-0162117
Descriptive risk assessment of the effects of acidic deposition on rocky mountain amphibians
CORN P S; VERTUCCI F A
US fish wildlife serv., national ecology res. cent., Fort Collins CO
80525-3400, USA
Amphibian declines and habitat acidification. Symposium (University Park
PA USA) 1991-08-08
Journal: Journal of herpetology, 1992, 26 (4) 361-369
ISSN: 0022-1511 CODEN: JHERAH Availability: INIST-19706;
354000032828610020
We evaluated the risk of habitat acidification to the six species of amphibians that occur in the mountains of Colorado and Wyoming. Our evaluation included extrinsic environmental factors (habitat sensitivity and amount of acidic atmospheric deposition) and species-specific intrinsic factors (sensitivity to acid conditions, habitat preferences, and timing of breeding). Only one of 57 surveyed localities had both acid neutralizing capacity <200 mu EQ/L AND SULFATE DEPOSITION >10 kg/ha/yr, extrinsic conditions with a possible risk of acidification- Amphibian breeding habitats in the Rocky Mountains do not appear to be sufficiently acidic to kill amphibian embryos

TITLE: MOVEMENTS WITHIN A POPULATION OF /RANA PRETIOSA PRETIOSA/ BAIRD AND GIRARD IN SOUTH CENTRAL MONTANA.
AUTHOR: Hollenbeck, Robert R.
SOURCE: J. Colo.-Wyo. Acad. Sci.; 8 (1): 72-73. Apr.
1976. Abstract only. WR 169
GEO. AREA: Montana, Southcentral
KEYWORDS: movements
TAXONOMIC NAME: Rana pretiosa pretiosa

TITLE: GROWTH RATES, BREEDING AGES, AND SEX-RATIOS WITHIN A POPULATION OF /RANA P. PRETIOSA/ BAIRD
AND GIRARD IN SOUTH CENTRAL MONTANA.
AUTHOR: Hollenbeck, Robert R.
SOURCE: J. Colo.-Wyo. Acad. Sci.; 7 (6): 44-45. May 1975. WR 165.

Appendix E.

Amphibian and Reptile Observation Form

Please provide whatever information you can, even if you are unsure of the species. Thank you.

Common Name/Species: _____

Description (size, color, pattern, pupil shape, skin texture, etc.):

_____

_____

Behavior: _____

_____

Date: _____ Time: _____

Location: _____

_____

County _____ State _____

Habitat: _____

_____

Weather (temperature, cloud cover, wind, etc.):

_____

Remarks: _____

Name: _____

Affiliation: _____

Address: _____

_____

Phone No: _____

Please return to:

Dr. Chuck Peterson
Department of Biological Sciences
Box 8007, Idaho State University
Pocatello, Idaho 83209
(208) 236-3922

Date	Time	Observer(s)	Species	Location	Remarks (#'s, weather, habitat, behavior, etc.)

INSTRUCTIONS FOR FILLING OUT THE AMPHIBIAN AND REPTILE OBSERVATION FORM

Please provide whatever information you can. The most important information is your description of the animal and its exact location. Because the distribution and natural history of amphibians and reptiles in the northern intermountain west is poorly known, your observations are potentially very important. They will be entered into a computerized database at the Idaho Museum of Natural History. Please contact us if you would like further information.

Species: Provide the common or scientific name of the animal if you know what it is. If you cannot identify it, please describe it as accurately as possible. Include the exact or estimated number observed(1-10, 10-100, more than 100, etc.).

Observer: Please include your name(s), address, and phone number so we can contact you if we need further information. The affiliation/relevant experience is to help us assess the reliability of your observation. Examples of affiliations are the U.S. Fish and Wildlife Service, Idaho Department of Fish and Game, Idaho State University, Idaho Herpetological Society, none, etc. Relevant experience could include coursework, training sessions, self-taught, none, etc.

Description: Describe the animal as accurately as you can so we can confirm your identification or so we can identify it from your description. Characteristics to note include size/length, shape, color, pattern (e.g., striped, banded, blotched, or unicolor), skin texture (e.g., smooth, shiny, rough, scaled, etc.), pupil shape (round or elliptical), and presence or absence of limbs and tail. See the references below for more information on identifying characteristics. Did you photograph the animal? If necessary, could we make or have a copy of the photograph?

Behavior: Behavioral descriptions are useful in identifying animals and are inherently interesting. For example: Was the animal moving or still? Did it crawl or jump or hop? Was it fast or slow? Was it trying to escape from you or was it hunting or feeding? Did it vocalize? What did it sound like?

Location: Be as accurate as possible. Try to describe the site so that someone else could relocate it from your directions. For example, in a small pond, 30 yards north of Highway X, 4.5 miles N and 3.3. miles east of a known landmark (junction, the center of a town, etc.). Please include the exact coordinates if you know them (latitude and longitude, UTMs, or Range, Township, Section, quarter section, etc.). Accurate locality information greatly enhances the value of your observation.

Habitat: Describe the major environmental features and habitat (such as lodge pole pine forest on mountain side, grasslands in a valley meadow, river, lake, etc.) and the immediate area around the animal (burrow, talus slope, stream bank, etc.).

Weather: If available, include measurements or estimates of the air temperature, water temperature, wind speed, cloud cover, and precipitation.

General Comments: Please include any other comments you wish to make.

Useful References:

Baxter, G.T. and M.D. Stone. 1985. Amphibians and reptiles of Wyoming. Second edition. Wyoming Game and Fish Dept. 137 pp.

Leonard, W.P., H.A. Brown, L.C. Jones, K.R. McAllister, and R.M. Storm. 1993. Amphibians of Washington and Oregon. Seattle Audubon Society, Seattle, Washington. (excellent color photographs)

Nussbaum, R.A. E.D. Brodie, and R.M. Storm. 1983. Amphibians and reptiles of the Pacific Northwest. University Press of Idaho, Moscow. 332 p. (The best general source of information on the amphibians and reptiles of Idaho).

Stebbins, R.C. 1985. A field guide to western reptiles and amphibians. Houghton Mifflin Co., Boston. 336 pp. (The best field guide to the amphibians and reptiles of the western United States).

Appendix F.

AMPHIBIAN SURVEY DATA SHEET – US FISH & WILDLIFE SERVICE, 4512 McMURRY AVE, FT. COLLINS, CO 80525-3400

(circle choice for shaded variables; supply value for others) (ver. 2/7/92)

DATE	BEGIN TIME	END TIME	OBSERVERS

LOCALITY

STATE	COUNTY	MAP NAME	OWNER	ELEVATION (circle scale) M FT

T	R	S	SECTION DESCRIPTION	UTM ZONE	NORTHING (or LAT)	EASTING (or LON)

AMPHIBIAN AND/OR GARTER SNAKE SPECIES PRESENT (INDICATE NUMBERS IN CATEGORIES IF POSSIBLE) — CIRCLE METHOD AND INDICATE IF VOUCHER SPECIMEN WAS COLLECTED

SPECIES	ADULTS/JUVENILES	CALLING?	TADPOLES/LARVAE	EGG MASSES	METHOD:
		Y N			VISUAL/AURAL ID DIP NET/SEINE HAND COLLECTED TRAPPED VOUCHER COLLECTED? YES NO
		Y N			VISUAL/AURAL ID DIP NET/SEINE HAND COLLECTED TRAPPED VOUCHER COLLECTED? YES NO
		Y N			VISUAL/AURAL ID DIP NET/SEINE HAND COLLECTED TRAPPED VOUCHER COLLECTED? YES NO
		Y N			VISUAL/AURAL ID DIP NET/SEINE HAND COLLECTED TRAPPED VOUCHER COLLECTED? YES NO
		Y N			VISUAL/AURAL ID DIP NET/SEINE HAND COLLECTED TRAPPED VOUCHER COLLECTED? YES NO

FISH PRESENT? YES ??? NO	FISH SPECIES:	
ENTIRE SITE SEARCHED? YES NO	IF NO, INDICATE AREA	METERS OF SHORELINE M² OF HABITAT

PHYSICAL AND CHEMICAL ENVIRONMENT (CHEMISTRY VARIABLES OPTIONAL - USE EXTRA SPACES FOR ADDITIONAL MEASUREMENTS)

WEATHER: CLEAR OVERCAST RAIN SNOW	WIND: CALM LIGHT STRONG

AIR TEMP (circle scale) °C °F	WATER TEMP (circle scale) °C °F	COLOR: CLEAR STAINED	TURBIDITY: CLEAR CLOUDY

pH	ANC		

SITE DESCRIPTIONS - (SKETCH SITE AND PUT ADDITIONAL COMMENTS ON BACK OF SHEET)
OMIT THIS SECTION IF DATA HAVE BEEN COLLECTED ON A PREVIOUS VISIT

ORIGIN: NATURAL MAN-MADE	DRAINAGE: PERMANENT OCCASIONAL NONE

DESCRIPTION:	PERMANENT LAKE/POND	TEMPORARY LAKE/POND	MARSH/BOG	STREAM	SPRING/SEEP	ACTIVE BEAVER POND	INACTIVE BEAVER POND

SITE LENGTH (M)	SITE WIDTH (M)	MAXIMUM DEPTH:	< 1 M	1 - 2 M	> 2 M

STREAM ORDER	1	2	3	4	5 +

PRIMARY SUBSTRATE:	SILT/MUD	SAND/GRAVEL	COBBLE	BOULDER/BEDROCK	OTHER

% OF POND LAKE MARGIN WITH EMERGENT VEGETATION:	0	1 - 25	25 - 50	> 50

EMERGENT VEGETATION SPECIES (LIST IN ORDER OF ABUNDANCE)				

NORTH SHORELINE CHARACTERS:	SHALLOWS PRESENT	SHALLOWS ABSENT	EMERGENT VEG PRESENT	EMERGENT VEG ABSENT

DISTANCE (M) TO FOREST EDGE	FOREST TREE SPECIES:			

It appears complex and intimidating, but actually can be completed in a short amount of time after a minimal [illegible]. Most variables are [illegible] to be circled, and the remaining variables are numerical and easy to determine. The data sheet is divided into four sections, divided by double lines. Each section describes a cohesive set of variables. In addition the back of the sheet includes a grid for a rough sketch of the site and space for additional comments. The map is optional, but the future value of the data is enhanced if it is supplied.

SECTION 1 – LOCALITY *These data are essential. Many amphibian surveys have been hampered by the inability to relocate exact locations in the historical record. Some of this information can be completed in the office after the survey.*

DATE: Use the format DD-MMM-YY (e.g., 05-APR-92).

BEGIN TIME: List the time survey of habitat for amphibians began in 24 hour format.

END TIME: List the time the survey ended in 24 hour format. (The total time (END TIME - BEGIN TIME) should reflect only the amount of time spent searching for amphibians. Total time plus number of observers may be used to assess relative abundance.)

OBSERVERS: List names or initials of all persons involved in searching.

LOCALITY: Describe the *specific* geographic location of the site. Use air distance in two directions (e.g., 5km N and 7.5 km W) of a map landmark that likely will not change (distance from a large town or city is not all that helpful).

STATE: Use the 2-letter abbreviation.

COUNTY:

MAP NAME: List the name of the U.S.G.S. quadrangle or other map used to locate the site.

OWNER: List the public land manager (e.g., Roosevelt Nat. Forest or Rocky Mtn NP), or name of the owner if the site is on private land (listing the owner's name will make it clear that you did not trespass to survey the site).

ELEVATION: Circle the scale used; meters are preferred.

T: township **R:** range **S:** section

SECTION DESCRIPTION: Describe the location of the site within the section (e.g., SE ¼ or NE ¼ of SE ¼)

UTM ZONE, NORTHING, EASTING: Universal Transverse Mercator coordinates are preferred over longitude and latitude. The UTM zone is listed on newer topographic maps. If you are using a map without the UTM grid, substitute latitude for Northing and longitude for Easting.

SECTION 2 – SPECIES DATA *List all amphibian species observed. If garter snakes are seen, list them here also.*

SPECIES: Use the scientific name. Convenient shorthand is to use a 4-letter code made up of the first 2 letters of the genus and species (e.g., *Rana sylvatica* would be RASY).

ADULTS/JUVENILES: Indicate presence with a check, but numbers seen are more valuable data

CALLING?: Circle Y if frogs are vocalizing in a breeding chorus, of if a breeding aggregation of species that don't call (e.g., *Bufo boreas*) is observed.

TADPOLES/LARVAE: Same as for adults/juveniles

EGG MASSES: Same as above. Numbers of egg masses are especially valuable data. If possible, describe the developmental stage of eggs in the space for additional notes on the back of the form.

METHOD: Circle how observations were made: **VISUAL/AURAL ID** – species identified without picking it up, either by sight or by recognition of the breeding call; **HAND COLLECTED** – animal was picked up and identified in the field (higher confidence than visual id); **DIP NET/SEINE** – the usual method of collection for larvae; **TRAPPED** – minnow-type traps are also used for larvae; **VOUCHER COLLECTED?** – circle yes or no (voucher specimens are recommended for every site, *especially if identification is uncertain and for larvae*). Indicate voucher status in addition to method used.

FISH PRESENT?: If yes, list species if you can. Circle the question marks if you are not certain, but suspect that fish are present.

ENTIRE SITE SEARCHED?: If no, list either the meters of shoreline or the area (m^2) of habitat (e.g., amount of wet meadow) searched.

SECTION 3 – PHYSICAL AND CHEMICAL DATA *Water chemistry data are difficult to collect accurately without thorough planning and quality equipment; these data are optional. Weather data are important for determining the quality of the observations (e.g., was an absence of amphibians due to observations made during a blizzard?)*

WEATHER, WIND: Indicate atmospheric conditions

AIR TEMPERATURE: Take at chest height in shade. The Celsius scale is preferred.

WATER TEMPERATURE: Take 1 meter from margin and at 2 cm depth, or where egg masses are observed.

COLOR: This is a qualitative assessment of whether the water clear or tea-colored from organic (humic) acids.

TURBIDITY: This is a qualitative assessment of whether the water clear or clouded from suspended particulate matter.

SECTION 4 – HABITAT DESCRIPTION *These data are important for developing hypotheses to explain changes in abundance of amphibians. This section needs to be filled out only once for each site (a reasonable amphibian survey should include at least 2 – 3 visits to each site in one season).*

ORIGIN: Decide whether the lake is a natural geologic formation or man-made. Bodies of water enlarged by a dam are problematic. List them as man-made, but add an explanation in the space for additional notes on the back of the form.

DRAINAGE: Circle whether the site has permanent drainage, no drainage, or occasional drainage. Determining the potential for occasional drainage requires judgement. Look for clues in the topography and vegetation.

DESCRIPTION: Decide how best to describe the site. If there is evidence of past or present beaver activity, circle one of these choices in addition to your choice.

LENGTH, WIDTH: Record the maximum length and width of lakes and ponds. For streams, record the length and average width of the reach searched.

MAXIMUM DEPTH: Most times, you will not have access to a boat, so estimate depth (deep lakes are usually not important to amphibians).

STREAM ORDER: This is an index of stream size, and you will need a topographic map to determine it. First-order streams have no tributaries, second-order streams are formed by the confluence of two 1st-order streams, third-order streams are formed by the confluence of two 2nd-order streams, and so on.

PRIMARY SUBSTRATE: Circle the type that covers the majority of the bottom of the site.

EMERGENT VEGETATION: Circle the percentage of the margin of the site with emergent vegetation present, and list the dominant species. If you are botanically-disadvantaged, list the categories of the dominant species (e.g., cattail, sedges, etc.).

NORTH SHORELINE CHARACTERS: Describe the north shore of a lake or pond in terms of shallow water and emergent vegetation. This is important in evaluating quality of breeding habitat in some mountain locations.

FOREST CHARACTERS: List the closest distance between the water and the surrounding forest, and list the most common tree species. Leave these fields blank if there is no forest. Describe other surrounding habitat types in the notes section on the back of the form.

Appendix G.

AMPHIBIAN POPULATION MONITORING DATA SHEET

Study Site _____

Observers/Teams[1] _____

Date _____ Begin Time _____ End Time _____ Total Search Time[2] _____

Air Temperatures at 1 m[3] _____ Water Temperatures at 2 cm[4] _____

Wind[5] _____ Cloud Cover _____% Radiation[6] _____

Remarks about Environmental Conditions:[7]

_____

_____

SPECIES[8]	ADULTS/JUVENILES[9]	TADPOLES/LARVAE[10]	EGG MASSES (#)	CALLING? (Y/N,#)
Tiger Salamander				
Western Toad				
Chorus Frog				
Spotted Frog				

Remarks:[11]

_____

_____

_____

Notes:

[1] Indicate if observers searched together or independently.
[2] Total search time = the elapsed time X the number of "teams" searching.
[3] Shade thermometer when measuring air temperature.
[4] Measure water temperatures in sunlit and shaded water 1 m from shore or where egg masses are observed.
[5] Estimate wind speed (still, light, moderate, heavy).
[6] Estimate solar radiation conditions (sun blocked completely or partially by clouds, clear, etc.)
[7] Indicate any significant changes in environmental conditions since the last visit (e.g., changes in water level).
[8] In the unlikely event that you see some species not in this table (e.g., a leopard frog), describe it under remarks.
[9] Indicate numbers of individuals. If you can distinguish adults, juveniles, and newly metamorphosed individuals, please do so.
[10] Indicate the appropriate category for tadpole numbers observed (e.g., 1-10, 10-100, > 100, > 1000).
[11] Under remarks, indicate any other significant observations (e.g., the presence of predators such as fish, garter snakes, and sandhill cranes). Please include suggestions for improving this data form.

If you have questions, please contact:

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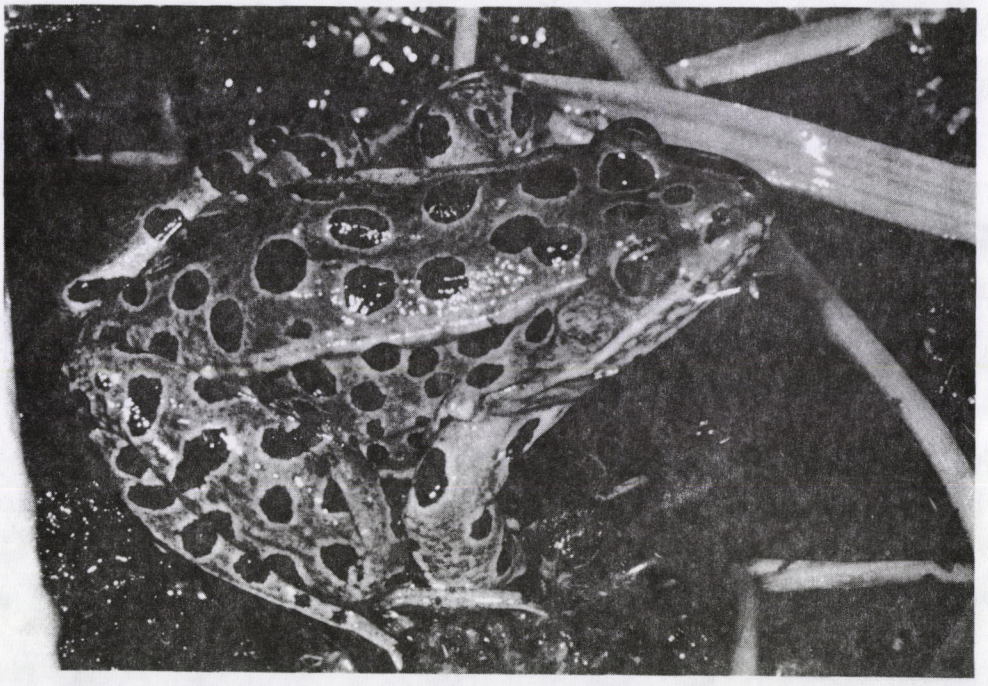
Appendix H: Adult Spotted Frog (Rana pretiosa), (a) dorsal view, and (b) ventral view.

A.

B.

Appendix I: (a) Adult Northern Leopard Frog (Rana pipiens) and (b) Western Boreal Toad (Bufo boreas).

A.



B.